SOCIETY OF ACTUARIES/CASUALTY ACTUARIAL SOCIETY

EXAM FM   FINANCIAL MATHEMATICS

SAMPLE QUESTIONS AND SOLUTIONS FOR *DERIVATIVES MARKETS*

SAMPLE QUESTIONS FOR EXAM FM/2

These questions have been written to assist the student in studying for the Course FM/2 exam. They are not intended to cover the entire breadth of the syllabus for Financial Economics.

1. Which statement about zero-cost purchased collars is FALSE?

    A. A zero-width, zero-cost collar can be created by setting both the put and call strike prices at the forward price.
    B. There are an infinite number of zero-cost collars.
    C. The put option can be at-the-money.
    D. The call option can be at-the-money.
    E. The strike price on the put option must be at or below the forward price.

2. You are given the following information:

    *   The current price to buy one share of XYZ stock is 500.
    *   The stock does not pay dividends.
    *   The risk-free interest rate, compounded continuously, is 6%.
    *   A European call option on one share of XYZ stock with a strike price of K that expires in one year costs 66.59.
    *   A European put option on one share of XYZ stock with a strike price of K that expires in one year costs 18.64.

    Using put-call parity, determine the strike price, K.

    A. 449
    B. 452
    C. 480
    D. 559
    E. 582

3. Happy Jalapenos, LLC has an exclusive contract to supply jalapeno peppers to the organizers of the annual jalapeno eating contest. The contract states that the contest organizers will take delivery of 10,000 jalapenos in one year at the market price. It will cost Happy Jalapenos 1,000 to provide 10,000 jalapenos and today's market price is 0.12 for one jalapeno. The continuously compounded risk-free interest rate is 6%.

Happy Jalapenos has decided to hedge as follows (both options are one-year, European):

Buy 10,000 0.12-strike put options for 84.30 and sell 10,000 0.14-stike call options for 74.80.

Happy Jalapenos believes the market price in one year will be somewhere between 0.10 and 0.15 per pepper. Which interval represents the range of possible profit one year from now for Happy Jalapenos?

A. –200 to 100
B. –110 to 190
C. –100 to 200
D. 190 to 390
E. 200 to 400

4. Zero-coupon risk-free bonds are available with the following maturities and yield rates (effective, annual):

Maturity (years)	Yield
1	0.06
2	0.065
3	0.07

You need to buy corn for producing ethanol. You want to purchase 10,000 bushels one year from now, 15,000 bushels two years from now, and 20,000 bushels three years from now. The current forward prices, per bushel, are 3.89, 4.11, and 4.16 for one, two, and three years respectively.

You want to enter into a commodity swap to lock in these prices. Which of the following sequences of payments at times one, two, and three will NOT be acceptable to you and to the corn supplier?

A. 38,900, 61,650, 83,200
B. 39,083, 61,650, 82,039
C. 40,777, 61,166, 81,554
D. 41,892, 62,340, 78,997
E. 60,184, 60,184, 60,184

5. You are given the following information:

   - One share of the PS index currently sells for 1,000.
   - The PS index does not pay dividends.
   - The effective annual risk-free interest rate is 5%.

   You want to lock in the ability to buy this index in one year for a price of 1,025. You can do this by buying or selling European put and call options with a strike price of 1,025. Which of the following will achieve your objective and also gives the cost today of establishing this position.

   A. Buy the put and sell the call, receive 23.81
   B. Buy the put and sell the call, spend 23.81
   C. Buy the put and sell the call, no cost
   D. Buy the call and sell the put, receive 23.81
   E. Buy the call and sell the put, spend 23.81

6. The current price of one share of XYZ stock is 100. The forward price for delivery of one share of XYZ stock in one year is 105. Which of the following statements about the expected price of one share of XYZ stock in one year is TRUE?

   A. It will be less than 100
   B. It will be equal to 100
   C. It will be strictly between 100 and 105
   D. It will be equal to 105
   E. It will be greater than 105.

7. A non-dividend paying stock currently sells for 100. One year from now the stock sells for 110. The risk-free rate, compounded continuously, is 6%. The stock is purchased in the following manner:

   - You pay 100 today
   - You take possession of the security in one year

   Which of the following describes this arrangement?

   A. Outright purchase
   B. Fully leveraged purchase
   C. Prepaid forward contract
   D. Forward contract
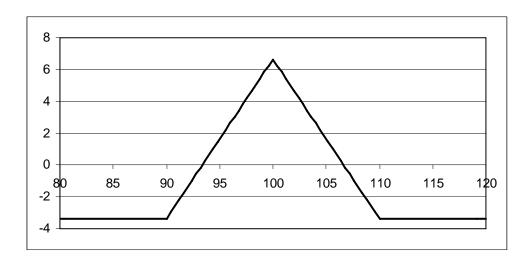   E. This arrangement is not possible due to arbitrage opportunities

8. You believe that the volatility of a stock is higher than indicated by market prices for options on that stock. You want to speculate on that belief by buying or selling at-the-money options. What should you do?

   A. Buy a strangle
   B. Buy a straddle
   C. Sell a straddle
   D. Buy a butterfly spread
   E. Sell a butterfly spread

9. You are given the following information:

- The current price to buy one share of ABC stock is 100
- The stock does not pay dividends
- The risk-free rate, compounded continuously, is 5%
- European options on one share of ABC stock expiring in one year have the following prices:

Strike Price	Call option price	Put option price
90	14.63	0.24
100	6.80	1.93
110	2.17	6.81

A butterfly spread on this stock has the following profit diagram.

Which of the following will NOT produce this profit diagram?

A. Buy a 90 put, buy a 110 put, sell two 100 puts
B. Buy a 90 call, buy a 110 call, sell two 100 calls
C. Buy a 90 put, sell a 100 put, sell a 100 call, buy a 110 call
D. Buy one share of the stock, buy a 90 call, buy a 110 put, sell two 100 puts
E. Buy one share of the stock, buy a 90 put, buy a 110 call, sell two 100 calls.

SOLUTIONS

Question #1
Answer is D

If the call is at-the-money, the put option with the same cost will have a higher strike price. A purchased collar requires that the put have a lower strike price. **(Page 76**)

Question #2
Answer is C

$66.59 - 18.64 = 500 - K\exp(-0.06)$ for $K = 480$ **(Page 69)**

Question #3
Answer is D

The accumulated cost of the hedge is $(84.30-74.80)\exp(.06) = 10.09$.
Let x be the market price.
If $x < 0.12$ the put is in the money and the payoff is $10,000(0.12 - x) = 1,200 - 10,000x$.
The sale of the jalapenos has a payoff of $10,000x - 1,000$ for a profit of $1,200 - 10,000x$
$+ 10,000x - 1,000 - 10.09 = 190$.
From 0.12 to 0.14 neither option has a payoff and the profit is $10,000x - 1,000 - 10.09 = 10,000x - 1,010$.
If $x > 0.14$ the call is in the money and the payoff is $-10,000(x - 0.14) = 1,400 - 10,000x$.
The profit is $1,400 - 10,000x + 10,000x - 1,000 - 10.09 = 390$.
The range is 190 to 390. **(Pages 33-41)**

Question #4
Answer is B

The present value of the forward prices is $10,000(3.89)/1.06 + 15,000(4.11)/1.065^2 + 20,000(4.16)/1.07^3 = 158,968$. Any sequence of payments with that present value is acceptable. All but B have that value. **(Page 248)**

Question #5
Answer is E

If the index exceeds 1,025, you will receive $x - 1,025$. After buying the index for x you will have spent 1,025. If the index is below 1,025, you will pay $1,025 - x$ and after buying the index for x you will have spent 1,025. One way to get the cost is to note that the forward price is $1,000(1.05) = 1,050$. You want to pay 25 less and so must spend $25/1.05 = 23.81$ today. **(Page 112)**

Question #6
Answer is E

In general, an investor should be compensated for time and risk. A forward contract has no investment, so the extra 5 represents the risk premium. Those who buy the stock expect to earn both the risk premium and the time value of their purchase and thus the expected stock value is greater than $100 + 5 = 105$. **(Page 140)**

Question #7
Answer is C

All four of answers A-D are methods of acquiring the stock. The prepaid forward has the payment at time 0 and the delivery at time T. **(Pages 128-129)**

Question #8
Answer is B

Only straddles use at-the-money options and buying is correct for this speculation. **(Page 78)**

Question #9
Answer is D

This is based on Exercise 3.18 on **Page 89**. To see that D does not produce the desired outcome, begin with the case where the stock price is S and is below 90. The payoff is $S + 0 + (110 - S) - 2(100 - S) = 2S - 90$ which is not constant and so cannot produce the given diagram. On the other hand, for example, answer E has a payoff of $S + (90 - S) + 0 - 2(0) = 90$. The cost is $100 + 0.24 + 2.17 - 2(6.80) = 88.81$. With interest it is 93.36. The profit is $90 - 93.36 = -3.36$ which matches the diagram.